

POWRE: Investigation of Laser-Target Interactions in Pulsed Laser Deposition  
Using a Picosecond, Tunable Free Electron Laser  
Anne Reilly, College of William and Mary, DMR-9973967

The Thomas Jefferson National Accelerator Facility Free Electron Laser (TJNAF-FEL) in Virginia provides a unique opportunity for studying pulsed laser deposition (PLD). The combination of parameters of this laser, including sub-picosecond pulses, high average power, high repetition rate and tunability, makes it a unique tool for the study of the effects of laser parameters on thin film quality.

PLD with the high repetition rate free electron has shown very different plasma emission than that observed with conventional lasers. The films grown with this technique are very high quality and are grown with extremely high deposition rates. This opens the door for study of a wide range of materials with laser parameters previously unavailable.



Figure 1. Intense plasma emission from ablation of Nb in pulsed laser deposition with the TJNAF-FEL.

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## Educational:

2 graduate students

1 undergraduate student

Undergraduate and graduate students had the opportunity to work with the newly commissioned TJNAF-FEL, the highest average power FEL in the world. They were trained in pulsed laser deposition, optical spectroscopy and thin film characterization.

A lecture on pulsed laser deposition was developed and delivered in graduate student seminars and a graduate course on lasers.

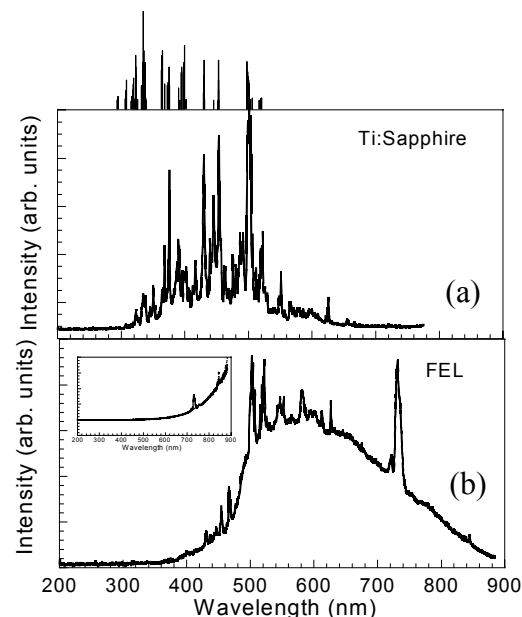


Figure 2: Optical spectra recorded from ablation of Ti with a) an amplified Ti:Sapphire laser and b) the TJNAF-FEL. The plasma emission is very different, with blackbody emission dominating in FEL-PLD. Inset: Spectra corrected for spectrometer response, with fit for blackbody emission.